Brief Report

Utility of VIG-Frail index in a ED short-stay unit: frailty and mortality correlation

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Abstract: (1) Background: Frailty assessment allows identification of patients at risk of death, and is a challenge in the emergency department or its support wards. The aim is to study Frail-VIG Index (FI-VIG) ability to discriminate frailty groups of older adults and its correlation with mortality in an short-stay unit; (2) Methods: observational, single-center, prospective study consecutively included patients over 65 years old admitted to the unit between March 1, 2021-April 30, 2021. (3) Results: 302 patients were included (56% women); mean age 82.6±7.7 years; 39.1% of them had functional disability and 16.5% had dementia. Of them, 174 patients (58%) met frailty criteria (FI-VIG ≥0.2; 111 (63.8%) mild frailty (FI-VIG 0.2 - 0.36); 52 (29.9%) moderate frailty (FI-VIG 0.36 - 0.55) and 11 (6.3%) advanced frailty (FI-VIG >0.55). Mortality at one year was analyzed: no frailty (n=16; 12.5%); mild frailty (n=25;22.5%); moderate (n=22;42.3%); advanced (n=7;63.6%), showing significant differences between groups (p<0.003). Mild Frailty vs Non-Fragile HR 2.47 (95%CI 1.12 - 5.46; Moderate Frailty vs Non-Fragile HR 6.93 (95%CI 3.16 - 15.23); Advanced Frailty vs Non-Fragile HR 11.29 (95%CI 3.54 - 36.03). (4) Conclusions: There was a strong correlation between frailty degree and mortality at 1, 6 and 12 months. FI-VIG Index is a fast, easy-to-use tool and allows personalization of care.

Keywords: Emergency, Frailty, Mortality, IF-VIG

1. Introduction

Population ageing is increasing exponentially. In 2030, 1 in 6 individuals in the world will be over 65 years. It is estimated that in 2050, 2 billion people will be over 65 years[1] and the number of individuals over 80 years will triple between 2020 and 2050, reaching 426 million people[2]. All of this has several implications for health and social care planning[3].

The most complex expression of population ageing is frailty, that can be defined as a state of vulnerability to poor recovery after an stressor event, leading to an increased risk of disability, hospitalization and mortality[3]. This increased vulnerability is specially revealed under several circumstances, like acute illnesses and hospitalization[4]. Consequently, frailty is a multifactorial syndrome with a high impact on patient´s health and is associated with delirium, disability, long-stay hospitalization, institutionalization and mortality[5]. Hence, frail elderly patient are usually high costs-high needs patients, requiring a high degree of attention by healthcare systems[6], and are a growing group in hospital Emergency Departments (ED)[7].

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Frailty assessment is a keystone in geriatric care and is of paramount importance to address the elderly population heterogeneity. Different authors suggest to use frailty assessment as an equivalence for biological age, as opposed to chronological age, which provides little value in clinical decision making[8,9]. A large number of tools have been proposed for frailty assessment, but each of them have specific characteristics and limitations, since they were validated in different healthcare settings[10]. Most commonly used scales differ in the number and type of deficits assessed, their validation environment, and the time and expertise required to be applicated[11].

Moreover, frailty is common in older patients in hospital wards and hospital ED, with reported prevalence rates between 21 and 62%. It is often related with non-specific symptoms, which are accompanied by a constellation of factors (physical, psychological, nutritional, pharmacological, functional and social) that must be properly identified and assessed to provide specific, tailored, and effective care in emergency department[12–14].

Multidisciplinary approach to frail patients should provide a Comprehensive Geriatric Assessment (CGA). CGA is the tool that allows a better understanding of the diverse and specific needs of the elderly at each stage of the care process, and an appropriate planning of their care[3,15]. Despite this, the concepts of frailty identification and CGA are not commonly performed in the ED[16–22]. Cited barriers included feasibility of tools in the time pressured ED environment, lack of formal clinical frailty guidelines for the ED.

Short Stay Units (SSU) are ED supportive hospitalization units, that have demonstrated to be useful in avoiding or reducing overnight stays and days of admission[23–25]. The admission criteria, which are usually common to all of them, include patients with medical pathology, a clear diagnosis, and a stable condition not requiring close monitoring or invasive treatment, and with an expected hospitalization period lasting less than 72 hours[24,25]. Over the years, admitted population in SSU has presented a significant change, as a result of population aging, although the admission criteria have not changed[26]. SSU admitted patients are older, have more comorbidities and polypharmacy, and thus it seems necessary to include new strategies to identify risks in vulnerable individuals, while keeping hospital stays as short as possible. Frailty assessment may be useful, but there are no current recommendations on the best tool to apply for frailty screening in these units. The Fragile-VIG index (FI-VIG) is a frailty index (FI) developed by Amblàs et al. (C3RG, Chronicity Research Group of Central Catalonia), which offers both the possibility of doing a rapid CGA of individuals and calculating their grade of frailty, and which was initially validated in a cohort of patients over 85 years of age in a Acute Geriatric Unit (UGA)[11,27]. The index consists in a 22-item deficit rating scale. As the authors say, the results describes as a simple, quick tool (it's completed in 5-10 minutes), with excellent discriminative and predictive capacity in relation to mortality, and performs a multidimensional assessment of the patient.

The scale has subsequently been validated in the context of intermediate care or health care hospitals[28,29] as well as in the community setting, with the same results. The authors keep it available in different languages and free of charge at https://www.c3rg.com/index-fragil-vig.

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The aim of our study is to analyze the utility of FI-VIG in a new scenario, a ED SSU, and its performance to properly identify groups of patients with different grades of frailty and mortality risk.

2. Materials and Methods

An observational, single-center, prospective, cohort study was done in the short stay unit (SSU) of the Emergency Department of the Hospital de la Santa Creu i Sant Pau, a tertiary and university, urban, with 550-bed center. The SSU has 36 beds, reporting to the ED, with 2,243 admissions during 2021.

The study was approved by the Clinical Research Ethics Committee under sponsor code IIBSP-FRA-2020-74. The CEIC considered the request for informed consent unnecessary because it was a registry of a validated scale and a non-interventional study. All patients admitted to the SSU over 65 years between March 1, 2021 until April 30, 2021 and were consecutively included. Only patients admitted for end-of-life care treatment were excluded. After admission, patients were followed up for one year. Follow-up was by consultation of the Shared Health Record of Catalonia (HC3) and a 12-month telephone call to the patient or career. There was no loss to follow-up.

The research team consisted of two attending physicians from ED, SSU chief-nurse and 4 nurses. FI-VIG support was used. After initial training by the principal investigator, one of the nurses assessed IF-VIG within the first 24 hours of admission taking into account, as determined by the index, the patient's situation in the 30 days before to admission.

Based on the FI-VIG https://en.c3rg.com/index-fragil-vig, patients were categorized into non-frail (< 0.2), initial frailty (0.2 - 0.36), intermediate frailty (0.36 - 0.55) and advanced frailty (> 0.55).

The study variables were demographic and administrative data (date of birth, sex, date of admission to the short-stay unit, discharge date from the unit, reason for discharge); clinical data (comorbidities, functional and cognitive status, social status, geriatric syndromes).

Following the methodology recommended by the authors of the scale, the binary variables were scored as "0" absence and "1" presence of deficits. Money management, telephone use and medication management were assessed as instrumental activities of daily living. Weight loss of more than 5% was assessed as a nutritional marker; presence of depressive syndrome, insomnia and anxiety as emotional markers and presence of social vulnerability as a social marker. The presence of pain and dyspnea were considered as symptoms with severity criteria. Delirium, falls, ulcers, polypharmacy and dysphagia were assessed as geriatric syndromes. Finally, the existence of chronic diseases was recorded as "1", and in case of advanced chronic disease according to the NECPAL test, 2 points were assigned. In relation to ordinary variables, the Barthel index was used in 4 categories according to absence of dependence, mild, moderate-severe and severe dependence. Cognitive impairment was classified as 0 points no impairment, 1 point mild/moderate impairment and 2 points severe/very severe impairment. Mortality was monitored at admission, at 1 month, 6 months and 1 year through HC3 and telephone calls at 1 year.

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The result of the FI-VIG of each patient was not communicated to the healthcare team, so as not to modify clinical practice or perform any intervention at this stage of the study.

Categorical variables were described as frequency and percentage of available data, while quantitative variables were described as mean and standard deviation (SD). Descriptive statistics of the variables analyzed were performed using SPSS. Statistical significance (95% confidence interval/$p < 0.05$) for the variables between patients alive/death was determined by means of mean contrasts (for quantitative variables) and proportion contrasts (for qualitative variables). For survival analysis, the log-rank test was used to compare survival curves according to the FI-VIG value and ROC curve analysis to determine the prognostic capacity of FI-VIG for mortality code.

3. Results

3.1. Descriptive analysis of the cohort

- Of the 501 patients admitted to the SSU during the study period, 323 were over 65 years. Of these, 21 had been admitted for end-of-life care, and were excluded. A total of 302 patients were included, whose mean age was 82.62 years, 56% were women (n=169). Five percent of the patients (n=15) lived in a nursing home.
- A total of 60.9% of patients were independent for basic activities of daily living (ADLs, n=184). Mild-moderate dependence for ADLs was observed in 23.5% (n=71), moderate-severe in 10.3% of patients (n=31) and absolute dependence in 5.3% (n=16). Mild-moderate cognitive impairment GDS<5 (n=44) and moderate-severe cognitive impairment GDS>6 (n=6) accounted for 14.6% of patients. The data are presented in Table 1. In-hospital mortality of the cohort was 3% (n=9), at 1 month 12.3% (n=37), at 6 months 20.6% (n=62) and at 1 year 23.2% (n=70).
- Of the 302 patients included, 128 (42.4%) were categorized as non-fragile and 174 (57.6%) were categorized overall as fragile. Of these, 111 (36.8%) had initial frailty, 52 (17.2%) had intermediate frailty and 11 (3.6%) had advanced frailty.

Table 1. Characteristics of patients admitted to the Short Stay Unit.

Total population	**No frail** **N = 128 (42%)**	**Frail** **N = 174 (58%)**
Mean age (years)	79.63 ± 7.3	84.81 ± 7.3
Women	63 (20.9%)	106 (35.1%)
Men	65 (21.5%)	68 (22.5%)
Barthel	86 ± 12	50 ± 14
Dementia	3 (1%)	47 (15.6%)
Dementia GDS > 6	0	6 (2%)

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[1] Non-fragility: Fragile-VIG Index < 0.2; Fragility: Fragile-VIG Index ≥ 0.2

3.1. Time of test execution

- The mean running time of the index was 7 minutes per patient.

3.3 Mortality analysis

- Table 2 shows the differences in the percentage of mortality between frailty groups. In non-fragile patients, no death was detected during admission compared to 5.2% (n=9) in fragile patients (p=0.012). At 30 days, mortality was 6.3% (n=8) in non-fragile patients vs 16.7% (n=29) in fragile patients (p=0.007); at 6 months, 10.2% (n=13) in non-fragile patients vs 28.2% (n=49) in fragile patients (p=0.001) and at 1 year, it was 12.5%(n=16) in non-fragile vs 31% (n=54) in fragile patients (p=0.001).
- Figure 1 shows the results of the analysis of the correlation between mortality and FI-VIG by means of the log-rank test comparing the survival curves according to the IF-VIG value, discretized by the previously mentioned intervals.

Table 2. Mortality of patients according to frailty degree

	No frail	Mild frailty	Moderate Frailty	Advanced Frailty	p
Women N (%)	63 (49,2%)	65 (58,6%)	33 (63,5%)	8 (72,7%)	0.584
Age	79,63 ± 7,3	84 ± 7,5	86,1 ± 6,9	87 ± 6,3	0.256
In-hospital Mortality	0 (0)	2 (1,8)	5 (9,6)	2 (18,2)	0.024
30-day Mortality	8 (6,3%)	12 (10,8)	13 (25)	4 (36,4)	0.020
6-month Mortality	13 (10,2%)	25 (22,5)	18 (34,6)	5 (54,5)	0.045
12-month Mortality	16 (12,5%)	25 (22,5)	22 (42,3)	7 (63,6)	0.003

Table 2. Based on the Fragile-VIG index, patients were classified into non-fragile (< 0.2); mild frailty (0.2 - 0.36); moderate frailty (0.36 - 0.55) and advanced frailty (0.55 - 0.7).

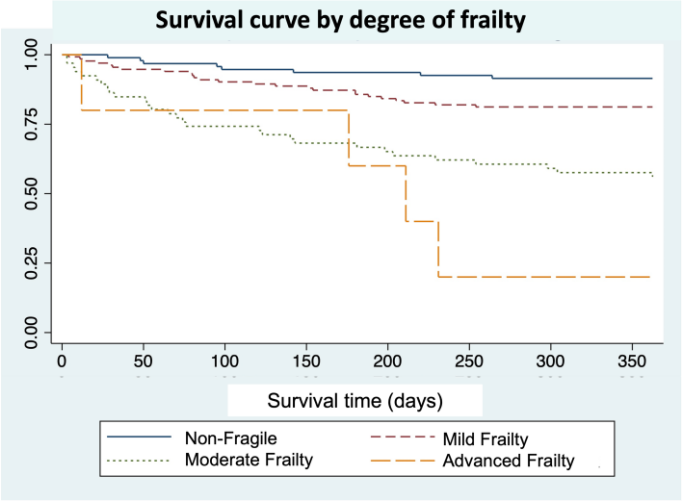

Figure 1. Survival curve by degree of frailty. Different frailty groups present significant differences in mortality (Hazard Ratio Mild Frailty vs Non-Fragile HR 2.47 CI95% 1.12 - 5.46; Moderate Frailty vs Non-Fragile 6.93 CI95% 3.16 - 15.23); Advanced Frailty vs Non-Fragile HR 11.29 CI95% 3.54 - 36.03).

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3.4 Model Usefulness

- A ROC analysis was performed at 12 months to check the usefulness of the model in the population studied. The ROC area under the curve was 0.7120 (95%CI 0.6423 - 0.7816).

4. Discussion

Our work shows that FI-VIG is a reliable and accurate tool for frailty screening in SSU, with a similar performance to that demonstrated in other settings. FI-VIG correlates frailty status with mortality, and our study shows that this correlation is still valid for a SSU setting.

It is well known that frailty status leads to progressively higher mortalities during hospital admission, as well as at 30 days, 6 months and 1 year after discharge. Although the SSU admitted patients showed different characteristics when compared with the population in which the FI-VIG was initially validated, the results of this study demonstrate that the FI-VIG is also applicable in this population. Although the results of the ROC curve are relatively lower than those obtained in the pivotal study, FI-VIG scale still offers a great discriminatory capacity between the different degrees of frailty. Furthermore, its performance mean time was 7 minutes, which confirms that it is a feasible, easy-to-use scale in a SSU setting.

Systematically measuring frailty is undoubtfully useful in patient management[28] and in SSU, FI-VIG turned out to be an accurate tool, that should be incorporated in clinical practice. FI-VIG assigns to each patient a numerical score, allowing its categorization in different frailty degrees, which in turn correlate well with mortality. In addition, as it is a multidimensional scale, it is able to detect several deficits in frail patients, that can be used as the base of a reglementary CGA[11,26]

Frailty assessment during SSU admission allows prompt patient referral to expert teams in order to initiate interventions focused on reversing or preventing secondary risks. By doing this, it improves the prevention of incidental geriatric syndromes during admission in frail individuals, as an specific care plan can be early designed (early mobilization, identification and correct management of delirium, prevention of constipation and falls, careful pain management, avoidance of medication-related risks and initiation of pharmaceutical care programs[31] among others). Finally, by frailty stratification, FI-VIG offers the chance of tailored interventions and therapeutic intensity for this patients[32,33].

Given the growing importance of frailty as an expanding public health problem, interventions like FI-VIG application in order to deliver an integrated care to older people across different settings could make acute and community care more responsive for all patients.

In our study, mean cohort age was 82.6 years, and almost 40% of patients had some degree of disability and 16.5% had dementia. As in other SSU in our country, the

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population is selected a priori by the criteria that determine the decision of admission to this unit, and the demographic characteristics of our cohort are similar to those reported in the literature in recent works[34]. Through FI-VIG application, we were able to determine that 57.6% of the patients in our SSU had some frailty degree, being most of them classified as mild (63.8%) or moderately (29.9%) frail. These data are relevant since we have not found similar studies describing frailty features in a SSU in our country. Despite being a previously selected population, with an expected short hospital stay, our study revealed that in our SSU there was a large group of frail individuals in whom FI-VIG performance could offer a great opportunity for tailored interventions.

We identified remarkable limitations in our study. It is a single-center study, and contains a low number of patients with advanced frailty, probably due to the narrow admission criteria in a SSU. Furthermore, it doesn't considers the concomitant diseases as factors that may influence in the survival rate. However, it has several strengths: it was designed as a prospective study, we recruited a large number of patients, and frailty assessment was performed by a small, highly-trained research team.

5. Conclusions

In conclusion, FI-VIG is a valid tool for systematic frailty identification in a SSU. In this setting, it keeps a good feasibility as well as diagnostic test accuracy, and allows early risk stratification, prompt CGA and tailored, specific interventions for each patient.

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Informed Consent Statement: Patient consent was obtained in all cases, as requested by the ethics committee.

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Conflicts of Interest: The authors declare no conflict of interest.

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